

Baryon Number Transport via Gluonic Junctions *

S. E. Vance †, M. Gyulassy† and X. N. Wang

Recent data on $p + A$ and $A + B$ interactions at the CERN SPS has revealed a large degree of stopping and strange hyperon production in the heavy nuclear systems. The stopping is significantly under-predicted by models which assume that the primary mechanism for baryon transport is diquark-quark ($qq - q$) hadronic strings.

In this paper, we consider another Regge motivated mechanism. This mechanism is motivated from the non-perturbative gluon field configuration (the baryon junction) that appears when writing the simplest gauge invariant operator for the baryon in $SU_c(3)$;

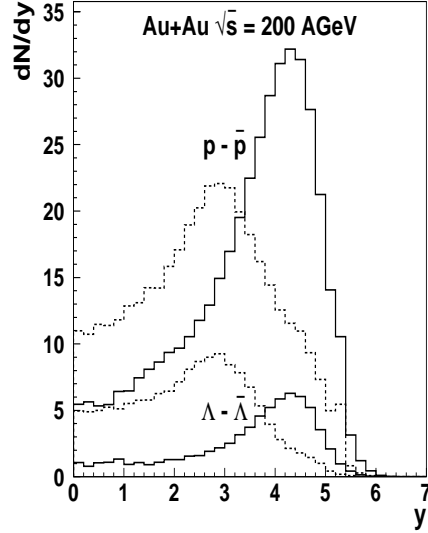
$$B = \epsilon^{j_1 j_2 j_3} \left[P \exp \left(ig \int_{x_1}^{x_J} dx^\mu A_\mu \right) q(x_1) \right]_{j_1} \times \left[P \exp \left(ig \int_{x_2}^{x_J} dx^\mu A_\mu \right) q(x_2) \right]_{j_2} \times \left[P \exp \left(ig \int_{x_3}^{x_J} dx^\mu A_\mu \right) q(x_3) \right]_{j_3} (1)$$

Here, the baryon junction is the vertex at x_J where the three gluon Wilson lines link the three valence quarks to form the gauge invariant non-local operator. In a highly excited baryonic state, the Wilson lines represent color flux tubes. When these strings fragment via $q\bar{q}$ production, the resulting baryon will be composed of the three sea quarks which are linked to the junction while the original valence quarks will emerge as constituents of three leading mesons. Being a gluonic configuration, it was proposed that the junction could be more easily transported into the mid-rapidity region in hadronic interactions. This mechanism is now modeled in a new version HIJING/B Monte Carlo program.

This gluonic mechanism can account for the observed large mid-rapidity valence baryon yield in $Pb + Pb$ at 160 AGeV and predicts high initial baryon densities at RHIC. However, the highly enhanced $\Lambda - \bar{\Lambda}$ yield and baryon transverse momentum flow observed in this reaction can only be partially described.

HIJING/B predicts approximately twice the initial number of valence protons and five times

the initial number of valence hyperons of HIJING at mid-rapidity leading to a prediction of twice the initial baryon density, $\rho(\tau_0) \approx 2\rho_0 \approx 0.3/\text{fm}^3$. Previous predictions for RHIC assuming idealized zero baryon chemical potential scenarios should therefore be re-examined.



Predictions for the initial valence proton rapidity distribution (upper two curves) and for the initial valence hyperon rapidity distribution (lower two curves) are given for Au+Au collisions at $E_{cm} = 200$ AGeV by HIJING (solid) and HIJING/B (dashed).

*Phys. Lett. **B443**,45(1998)

†Physics Department, Columbia University, New York, N.Y. 1002